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BOTANY.—*The identification of Raddi's Grasses.*[1] AGNES CHASE, U. S. Department of Agriculture.

One of the earliest works treating of the grasses of America is the Agrostografia Brasiliensis sive Enumeratio Plantarum ad familias naturales Graminum et ciperoidarum spectantium, quas in Brasilia collegit et descripsit [by] Josephus Raddius, published at Lucca, Italy, in 1823. This little book of 58 pages and one plate is exceedingly rare. In it are described 26 species of Cyperaceae (sedges) and 65 species of Poaceae (grasses). Of the latter five genera and 35 species are proposed as new. A few of these had been described earlier by Bertoloni in a paper in Opusculi scientifici . . di Bologna in 1819. Raddi's work and the specimens on which it is based are of great nomenclatorial importance to agrostology.

Giuseppe Raddi was born in Florence, Italy, February 9, 1770. In 1817, when the Austrian emperor seized the opportunity to send a scientific expedition to Brazil with the escort of the Archduchess Leopoldine on her voyage to Brazil to marry the heir apparent to the Brazilian throne, the Grand Duke of Tuscany sent Raddi to join the expedition. Raddi spent two years in Brazil in the vicinity of Rio de Janeiro. Presumably his work was chiefly that of securing seeds and living plants for the botanic gardens of Tuscany. He published three books based on his work in Brazil, Synopsis Filicum brasiliensium, 1819 (19 pages and 2 plates); Agrostografia brasiliensis, 1823; and Plantarum brasiliensium nova genera et species novae vel minus cognitae. Pars. I. Filices, 1825 (101 pages and 84 plates). Part I is the only one of the projected work ever published.

Raddi was later sent to Egypt and died at Rhodes on his return in 1829.

[1] Received March 9, 1923.

A set of Raddi's Brazilian grasses appears to have been given to the Museum at Florence but his own set is preserved in the University in Pisa.

In May, 1922, I visited the Museo e Laboratorio di Botanica, Florence, and the Instituto ed Orto Botanico della R. Universita in Pisa, for the purpose of studying these grasses. I took photographs of all Raddi's own species which I found in Pisa. Six I was not able to find. In the Pisa herbarium (and in Florence also) the visitor does not search the herbarium himself, he asks for the genera wanted and the packages are brought by an attendant. The Raddi grasses are distributed in the herbarium and it is possible that the missing specimens were distributed in genera I failed to guess.

The Raddi grasses in Pisa are unusually ample and well-prepared. They are mounted on the third page of a folder of rather heavy paper. The name is written on the outside of the folder (which could not be made to show in the photograph), and in most of the specimens there is a ticket bearing the name, usually in Raddi's hand, on the page with the specimen. There are no data on the tickets or on the folder, except that on the tickets that are not in Raddi's hand is written "Brasile."

In the Florence Herbarium I found several specimens of Paspalum with data on the labels. Among some undetermined grasses that Dr. Pampanini asked me to name were sixteen specimens without names or data other than "In Brasilia legit Cl. Raddi." Later I found a few Raddi specimens in the Delessert Herbarium and in the herbarium of the British Museum.

The following list is based on the Pisa specimens, those in the other herbaria are referred to only when they add some information, or when they differ from the Pisa specimens.

The species (beginning with the sedges) are numbered consecutively throughout the book. These numbers are used in the following list. Except in a few cases, only Raddi's own species are given.

ANNOTATED LIST OF RADDI'S SPECIES

RETTBERGIA, a new genus including one species

27. RETTBERGIA BAMBUSIOIDES. *pl. 1. f. 1.* "Circa verticem Montis Corcovado." The specimen is a single leafy branch with a small rather dense panicle. This is *Chusquea bambusioides* (Raddi) Hack. Hackel[2] refers *C. gaudichaudii* Kunth to this species. Kunth's plate

[2] Denkschr. Akad. Wiss. Math. Naturw. (Wien) **79**: 81. 1908.

and description agree well with the photograph and notes taken of Raddi's specimen.

29. OLYRA PUBESCENS. "In montosis ubique in Provincia Rio Janeiro." There are two specimens of this, each consisting of a leafy branch with a panicle. The sheaths and blades are puberulent; otherwise the specimens are like *O. latifolia* L. Doell reduces it to a variety of that species, *O. latifolia* var. *pubescens* (Raddi) Doell. It is scarcely worthy of varietal rank. A specimen of typical *O. latifolia* L. is labeled "*Olyra pubescens* var." in Raddi's script. This is evidently the form referred to as having glabrous blades and sheaths. Nees[3] cites this as "*Olyra pubescens* var. *glabra* Raddi . . . . ." under *Olyra scabra* Nees as a doubtful synonym.

In the Delessert Herbarium a specimen labeled "*Olyra pubescens* Raddi. Bresil: Raddi," but not in Raddi's script, is the same as *O. ciliatifolia* Raddi (no. 31).

30. OLYRA GLABERRIMA. "In Monte . . . . Corcovado." The specimen consists of the summit of a culm with three leaves and an immature panicle. The blades are very large, the largest being 26.5 cm. long and 5.6 cm. wide, short-petioled and with the base very unsymmetrical. The immature fertile lemma is densely bearded at the base and slightly at the summit with short thick hairs. *Olyra semiovata* Trin.,[4] "Brasil. (Langsdorff)," belongs to this species. Trinius's description applies well to Raddi's specimen, and a fragment from the Trinius Herbarium deposited in the United States National Herbarium shows an immature pistillate spikelet that agrees perfectly with that observed in the Raddi specimen. Raddi's description, "Corolla laevigata, straminea, coriaceo-indurata" is misleading. The lemma and palea are yellow (being very immature, as is the immature one from Trinius's specimen), but the dense pubescence at the base is to be seen by lifting up the sterile lemma. This characteristic fruit is well shown in Trinius's drawing of *O. semiovata*.[5] This species is well represented by Jardim Botanico do Rio de Janeiro no. 402 (without data other than Brazil) and *Ule* 979, "Pr. St. Catharina, Brazil."

31. OLYRA CILIATIFOLIA. "In saltibus montosis, et sepibus prope Rio-Janeiro, nec non in Montibus estrell." The specimen consists of two culms with immature panicles. The fruit shows the loose pubescence characteristic of the species as represented by *Hitchcock* 10133,

[3] Agrost. Bras. 307. 1829.
[4] Gram. Pan. 249. 1826.
[5] Trin. Gram. Icon. 3: 347. 1836.

Trinidad; *Lindman* A 2597, and *Glaziou* 14397, Brazil; *Hassler* 12444, 13021, and *Rojas* 3071, Paraguay; and *Ekman* 675, Argentina. The blades of the Raddi specimen are shorter in proportion to their width than common, as in *Hassler* 13021. In Grasses of the West Indies[6] the key is misleading in that the fruit of *Olyra ciliatifolia* is said to be "clothed with thick silky hairs at base and summit." The fruit is loosely pubescent throughout.

32. OLYRA FLORIBUNDA. "Ad radicem Montis Corcovado." The specimen consists of a tuft of five flowering culms and two sterile ones. Raddi cites "*Raddia brasiliensis.* Bert. Opusc. Scientif. di Bologna 1819. T. III p. 40." Bertoloni's detailed description agrees in every way with Raddi's specimen and was undoubtedly drawn up from a duplicate. (There seems to have been abundant material of this collection; there were two full sheets of it among the unidentified grasses in the herbarium at Florence, as well as a specimen in the Delessert Herbarium.) The distinguishing generic characters given are the distinct staminate and pistillate inflorescences. Bertoloni states that the generic name is given as a just tribute to Raddi and that the specific name commemorates his courageous voyage to Brazil. But Raddi declines the honor conferred on him and renames the species *Olyra floribunda.* He describes the distinct staminate and pistillate inflorescences but states that the style and stigmas are as in the three preceding species, and that they agree with the generic characters assigned by Swartz to *Olyra.* We recognize *Raddia* as a distinct genus, and this species as *R. brasiliensis* Bertol. The valid name under *Olyra* is *O. brasiliensis* (Bertol.) Spreng. I have seen no other collection which agrees exactly with the Raddi specimens. *Glaziou* 4336 and 12265, Brazil, probably belong to this species, but the blades are more than twice as large and the pistillate spikelets are larger and have a longer acuminate tip, but the spikelets are clothed, as in the Raddi specimens, with a dense short retrorse pubescence, with a few long stiff hairs intermixed.

33. PHARUS BRASILIENSIS. "Prope Rio-Janeiro." The specimen is a complete plant with a very immature panicle. The name on the folio is not "brasiliensis" but one that was not published. The plant agrees with Raddi's description, and as but one species of *Pharus* is given there can be no doubt that this is the type of *P. brasiliensis.* It agrees with rather narrow-leaved specimens of *Pharus glaber* H. B. K., such as *Blanchet* 1018, *Mosén* 1778, and *Dusén* 91, from

[6] Hitchcock & Chase, Contr. U. S. Nat. Herb. **18**: 357. 1917.

Brazil. The last, from Rio Janeiro, has a very immature panicle and is an excellent match for Raddi's specimen.

34. SPARTINA BRASILIENSIS. "In inundatis prope Rio-Janeiro." There are two sheets of this, consisting of the upper part of a thick culm with inflorescence exceeded by the blades. The specimen is well represented by Doell's plate[7] except that the Raddi spikelets have a few hairs, as in *Glaziou* 22412, Brazil.

36. PASPALUS OBTUSIFOLIUS. "In herbosis et humidiusculis locis prope Rio-Janeiro." The specimen consists of four plants of one flowering culm each, the two racemes not conjugate. No stolons are present but the base of one suggests a stoloniferous habit. This species belongs to the genus *Axonopus*, which differs from *Paspalum* in the reversed position of the spikelets,[8] **Axonopus obtusifolius** (Raddi) Chase. Doell[9] refers this species to *Paspalum furcatum* Flügge (*Axonopus furcatus* (Flügge) Hitchc.), but it is very different from that species, especially in the inflorescence. In that the racemes are conjugate and the spikelets glabrous while in *Axonopus obtusifolius* one racème is from 0.5 to 2 cm. below the other, and the spikelets are silky-villous at the base and with a narrow stripe of silky pubescence on the marginal internerves. *Ule* 975, from Brazil, agrees perfectly with Raddi's specimen and shows, besides, a leafy stolon.

39. PASPALUS ACUMINATUS. No locality is cited. The specimen consists of two leafy culms lacking the base, each with three racemes. This belongs to section *Ceresia* of *Paspalum* with broadly winged rachis, together with *P. dissectum* L., *P. serratum* Hitchc. & Chase, and *P. repens* Berg. It is the species given as *P. acuminatum* Raddi in Hitchcock's Mexican Grasses[10] and is well represented by *Brother Arsène* 3132, Mexico, and *Hassler* 10784, 11930 and 12471 from Paraguay.

40. PASPALUS LONGIFLORUS P. Beauv. Fl. de Ow. II 46. t. 85?—an Sp. nova. No locality is given. While Raddi does not here name a new species, "*Paspalum longiflorum* Raddi" has been given in synonymy by Doell and others. The specimen in the Pisa Herbarium consists of two culms of *Paspalum vaginatum* Swartz, both exceptional in the number of racemes, one having three, the other five. The specimen in the Florence Herbarium is *P. distichum* L.

41. PASPALUS FISSIFOLIUS. "Cum *Paspalo obtusifolio.*" (See above.) There are five plants on the sheet, one of two flowering culms

[7] Fl. Mart. Bras. 2^3: pl. 23. f. 2. 1878.
[8] See Chase, Proc. Biol. Soc. Washington **24**: 129. 1911.
[9] Fl. Mart. Bras. 2^3: 103. 1877.
[10] Contr. U. S. Nat. Herb. **17**: 230. 1913.

joined by a long stolon, three single flowering plants of the same, and a sterile tuft that is probably *Stenotaphrum secundatum* (Walt.) Kuntze. The flowering plants agree with the description. The apex of several of the blades is split. This splitting of the blades is not uncommon in *Axonopus*, the genus to which this species belongs. This species, **Axonopus fissifolius** (Raddi) Chase, is allied to *A. compressus* (Swartz) Beauv. It is much smaller than that, with narrower blades, 3 to 4 racemes, and smaller spikelets with longer less delicate pubescence. The Pisa specimens and those seen in Florence and Delessert are about 12 cm. tall, or less; the one in the British Museum has a culm 18 cm. tall. I have seen no other collection of this species.

42. PASPALUS CURVISTACHYUS. "In sylvestribus non procul ab urbe Rio Janeiro." There are two sheets of this, one with a ticket with the name in Raddi's script and two plants, the other with three plants. Both sheets contain two species, one, the left-hand plant on the first sheet and the left and middle plants on the second sheet, is the same as *Paspalum nutans* Lam., the type of which was examined in the Paris Herbarium. The description was evidently drawn up from both species, but two characters given, "glumis calycinis corolla brevioribus" (glume and sterile lemma shorter than the fruit), and "nodes rooting" apply to the specimens of *P. nutans* and not to the right-hand plant on each sheet. The left-hand plant of the second sheet, being the best specimen, is selected as the type. This specimen has four racemes in the terminal inflorescence and one on each of two branches. It is well matched by *Hitchcock* 10301, Trinidad, with three racemes in the terminal inflorescence.

The right-hand specimens on each sheet are over-mature single plants of *Paspalum arenarium* Schrad.

In the Delessert Herbarium a specimen of this collection "E Brasilia, Raddi" bears a name that was not published. It agrees with the type. The specimen in the Florence Herbarium is *P. arenarium*. Doell[11] refers *Paspalum curvistachyum* Raddi to *Panicum decumbens* Roem. & Schult. (*Paspalum decumbens Swartz*). That is an allied species with smaller spikelets in which the first glume is developed.

43. PASPALUS CORCOVADENSIS. "Monte Corcovado." The specimen consists of one entire plant and a second lacking the base. These agree perfectly with the description. They are well matched by *Gardner* 138, and *Mosén* 3512, from Brazil. Trinius[12] figures a different species with shorter broader blades and more numerous and

[11] Mart. Fl. Bras. 2[2]: 183. 1877.
[12] Gram. Icon. 2: 153. 1829.

denser racemes under the name *P. corcovadense* Raddi. Doell[13] reduces *P. corcovadense* Raddi to a variety of *P. laxum* Lam., changing the name to P. *laxum* β *Raddianum* Doell. The type specimen of *Paspalum laxum* Lam., examined in the Paris Herbarium, however, proves to be a very different species, closely allied to *P. glabrum* Poir.

I should take *Paspalum corcovadense* for the valid name of this species, through the description of *Paspalum lanceolatum* Mikan[14] is evidently drawn up in part from a specimen of this species. Dr. A. S. Hitchcock, who examined the Trinius Herbarium in 1907, found the specimen collected by Mikan in Brazil and bearing the name "*Paspalum lanceolatum*" to consist of two species, one of which is the same as Raddi's species, but the other a species not closely related. Trinius's description of the vegetative part applies much better to the latter, as does also the number of the racemes ("12–15"), but the description of the spikelets applies to *P. corcovadense* and not to the acute spikelets of the plant otherwise described. Neither of the specimens belongs to the species figured in the Icones as *P. corcovadense* (which Doell[15] names *P. densiflorum* Doell). Trinius later[16] reduces *P. lanceolatum* Mikan (described by himself in 1821) to *P. corcovadense* Raddi (1823), and cites his own plate also. The description is adjusted to cover the three species. For the type of *P. lanceolatum* Mikan; Trin., I select the plant with the acute spikelets, leaving *P. corcovadense* Raddi the valid name for the species represented by *Gardner* 138 and *Mosén* 3512, from Brazil.

44. PASPALUS INAEQUIVALVIS. "In sylvestribus prope Mata-Cavallos, non procul ab urbe Rio de Janeiro." The specimen consists of two plants, one lacking the base. This belongs to the species figured under this name by Kunth,[17] and is well represented by *Hassler* 12401 and *Rojas* 96 from Paraguay, and *Ekman* 569, from Misiones, Argentina.

The specimen in the Delessert Herbarium bears a name that was not published.

45. PASPALUS COMPRESSICAULIS. "In graminosis prope Rio-Inhumirim." The specimen consists of a complete plant of the common *Paspalum paniculatum* L.

48. *Piptatherum annulatum*. "An var Piptatherii punctati P. B.? . . . ad Fossas udas prope Rio-Janeiro." On the specimen is

[13] Mart. Fl. Bras. 2[3]: 85. 1877.
[14] Trin. in Spreng. Neu. Entd. 2: 48. 1821.
[15] Mart. Fl. Bras. 2[3]: 51. 1877.
[16] Mem. Acad. St. Petersb. VI. Sci. Nat. 1: 155. 1834.
[17] Rév. Gram. 2: pl. 207. 1829.

written "Pipt. punctatum P de Beauv. Roem. et Schult. II 328?" The specimen belongs to *Eriochloa punctata* (L.) Desv.

ACICARPA, a new genus with a single species.

49. ACICARPA SACCHARIFLORA, *pl. 1. f. 4.* No locality is given. *Milium hirsutum* Beauv. pl. 5, f. 5., and Sloane Hist. Jam. 1: 43. pl. 14. f. 2. are cited. The specimen consists of two panicles and four leafy shoots of *Valota insularis* (L.) Chase. The Beauvois and Sloane figures cited also represent this species.

AGROSTICULA, a new genus with a single species.

51. AGROSTICULA MURALIS. *pl. 1. f. 2.* "In veteribus muris prope Rio-Janeiro." The specimen consists of a tuft with mature panicles half the length of the entire plant. The species belongs in *Sporobolus*, *S. muralis* (Raddi) Hitchc. & Chase, as described in the Grasses of the West Indies.[18]

59. AIRA BRASILIENSIS. "In veteribus muris prope Rio Janeiro." No specimen of this could be found. The description agrees in every way with the plants referred by Hackel[19] to *Sporobolus brasiliensis* (Raddi) Hackel, based on *Aira brasiliensis* Raddi. Other specimens representing this species are *Sellow*, Brazil, the type collection of *Eragrostis airoides* Nees, and *Hassler* 11560, Paraguay. This species is peculiar in having a second floret in about half the spikelets of most of the specimens. Because of these 2-flowered spikelets it has been placed in *Eragrostis*, but the lemmas are 1-nerved, not 3-nerved as in *Eragrostis*.

ARUNDINELLA, a new genus with a single species.

60. ARUNDINELLA BRASILIENSIS. *pl. 1. f. 3.* "In collibus apricis prope Rio Janeiro." No specimen of this could be found. Raddi's figure of the spikelet indicates unmistakably the genus recognized under this name. The description points to the common species of Brazil, *A. hispida* (Willd.) Kuntze (*Andropogon hispidus* Willd. 1805), to which it has been generally referred.

NAVICULARIA, a new genus including three species, the third of which, *N. lanata*, being figured, is taken as the type. The three species belong in *Ichnanthus* Beauv. (1812).

Raddi says the genus is distinguished by the peculiar and constant structure of the spikelet, which has three valves of the corolla as well as three of the calyx. The three valves of the corolla are the fertile lemma, its well-developed wings (characteristic of the genus *Ichnanthus*) and the palea; the three valves of the calyx, the two glumes and the sterile lemma.

[18] Contr. U. S. Nat. Herb. **18**: 368. 1917.
[19] Bull. Herb. Boiss. II. 4^3: 278. 1904.

61. NAVICULARIA HIRTA. "In saltibus montosis prope Rio-Janeiro." (The locality of this is given with that of *N. glabra.*) The specimen could not be found in Pisa but in the British Museum is a specimen bearing the name in Raddi's script. The plant agrees with Raddi's description and also with that of *Panicum loliaceum* Bertol.,[20] (not Lamarck, 1791) which Raddi cites, having pilose glumes and well-developed wings on the lemma, pubescent sheaths, and blades puberulent beneath. Bertoloni refers to the wings of the lemma as nectaries. This species was referred by Nees[21] to *Panicum candicans* Nees, but in that the appendages of the fertile lemma are reduced to scars.

Doell[22] reduces *Navicularia hirta* to "*Ichnanthus planotis* Trin." making it var. *β pilosus* Doell. Doell gives Trinius as the author of *I. planotis,* but Trinius[23] published it as *Panicum planotis.*

Trinius's description (including three varieties) seems to include more than one species. A specimen in the Trinius Herbarium named "*Panicum planotis* m. var *β*" by Trinius and labeled "Rio Janeiro 86" is like the Raddi specimen. Trinius's brief description of *β* agrees with this plant. A specimen named "*Panicum planotis* m. var. *α*," "Rio Janeiro 269" is a species of *Panicum.* This agrees with "Append. nullis" given in the diagnosis of var. *α.* Raddi's specific name is the earliest tenable one of this species: **Ichnanthus hirtus** (Raddi) Chase.

Schultes[24] changes *Panicum loliaceum* Bertoloni, not Lamarck, to *Panicum Bertolonianum* Schult.

Except the two specimens mentioned I have seen none which belong to this species.

62. NAVICULARIA GLABRA. "In saltibus montosis prope Rio-Janeiro." No specimen of this could be found. Hitchcock[25] interprets Raddi's description and publishes the name *Ichnanthus glaber* (Raddi) Hitchc. The specimen cited by Hitchcock, *Rose* 20181, "on Corcovado, Rio de Janeiro," agrees perfectly with Raddi's description.

63. NAVICULARIA LANATA. *pl. 1. f. 5.* "In herbidis prope Rio-Inhumirim." The specimen is an immature plant of *Ichnanthus leiocarpus* (Spreng.) Kunth (*Panicum leiocarpum* Spreng. 1820), the

[20] Opusc. Sci. Bologna **3**: 408. 1819.
[21] Agrost. Bras. 133. 1829.
[22] Mart. Fl. Bras. **2**[2]: 280. 1877.
[23] Mem. Acad. St. Petersb. VI. Sci. Nat. **1**: 322. 1834.
[24] Mant. **2**: 240. 1824.
[25] Contr. U. S. Nat. Herb. **22**: 10. 1920.

panicle branches ascending instead of spreading as at maturity. This species is represented by *Botanic Garden Herb.* 3318, Trinidad, and *Riedel* 183, Bahia, Brazil.

64. OPLISMENUS BRASILIENSIS. "In montanis prope Tejucco, necnon in Monte Corcovado." The specimen consists of four simple plants of *Oplismenus hirtellus* (L.) Beauv. The sheaths are pubescent as in *Regnell* III 1373, from Brazil, and *Pittier* 5976, from Venezuela, as well as in numerous tropical North American specimens. The pubescence is rather soft, not stiff and bristly as in *Wright* 751, *Pringle* 76, and *Shafer* 3011, from Cuba; *Harris* 11465, 11607, from Jamaica; and *Hitchcock* 10222 and 10252, Tobago.

66. PANICUM UNCINATUM. "In sylvaticis prope Catumby, non procul ab Urbe Rio de Janeiro." No specimen of this could be found in Pisa, but in the herbarium of the British Museum is a specimen so named in Raddi's script. The upper spikelets are mature, showing the hooked, spine-like hairs. The plant is the same as the type of *Echinolaena polystachya* H. B. K., which was examined in the Berlin Herbarium. It is represented by the specimens cited under this name in Hitchcock's Mexican Grasses[26] and those cited under *Pseudechinolaena polystachya* (H. B. K.) Stapf in his Grasses of British Guiana.[27]

67. PANICUM PULCHELLUM. "In sylvaticis prope Catumby; non procul ab Urbe Rio de Janeiro." The specimen consists of a creeping plant with four flowering culms and another flowering culm without base. It belongs to the species described under this name in Hitchcock and Chase's North American Species of Panicum.[28]

68. PANICUM OLYRAEFOLIUM. *pl. 1. f. 6.* "In sepibus prope fossas udas in viciniis Rio-Janeiro" (the locality given with that of *P. donacifolium*). The specimen, consisting of two branching plants rooting at the nodes, and two additional flowering culms, belongs to *Panicum frondescens* Meyer, as described by Hitchcock and Chase.[29]

69. PANICUM CONDENSATUM. "In sepibus prope fossas udas in viciniis Rio-Janeiro." The specimen consists of a flowering culm, lacking the base, with sterile branches. Among the unidentified grasses in the Florence Herbarium were three sheets of this collection, the largest with a stout culm and blades reaching to 20 cm. long and 2.6 cm. wide. Raddi cites "Bert. Op. Sc. di Bol. An 1819. T. III p. 408." Bertoloni's description agrees well with Raddi's specimens.

[26] Contr. U. S. Nat. Herb. **17**: 223. 1913.
[27] Contr. U. S. Nat. Herb. **22**: 469. 1922.
[28] Contr. U. S. Nat. Herb. **15**: 123. 1910.
[29] Contr. U. S. Nat. Herb. **15**: 121. 1910.

Gaudichaud 288, Rio Janeiro, the type of *Panicum auriculatum* β *fasciculosum* Doell[30] and of *Panicum Januarium* Mez, and *Pabst* 706, from Brazil, both in the Berlin Herbarium, belong to *Panicum condensatum* Bertol. Of the eight collections cited by Mez[31] under *P. Januarium*, *Gaudichaud* 288, Rio de Janeiro, is taken as the type, because Mez cites "*Panicum auriculatum* var. *fasciculatum* Doell" (error for *fasciculosum*), and this is the only specimen Doell cites for the variety. The specimen in the Berlin Herbarium bears this name in Doell's script. The name in Mez's writing is not *Januarium* but one that was not published. The species belongs in *Hymenachne* Beauv. as described by Chase,[32] **Hymenachne condensata** (Bertol.) Chase. The species is represented in the U. S. National Herbarium by *Wilkes Expl. Exped.* 6, Rio Janeiro.

70. PANICUM DONACIFOLIUM. "In sepibus prope fossas udas in viciniis Rio-Janeiro." The specimen consists of two flowering culms, both lacking the base, with auriculate-clasping blades. It belongs to the species at present known as *Hymenachne auriculata* (Willd.) Chase,[33] or *Panicum auriculatum* Willd.,[34] the type specimen of which, labeled "Amer. merid. Humboldt," was examined in the Willdenow Herbarium in the Berlin Herbarium. Since Raddi's name is earlier it must replace that of Willdenow, **Hymenachne donacifolia** (Raddi) Chase. This species is represented in the U. S. National Herbarium by *Smith* 2748, Santa Marta, Colombia; *Eggers* 14633, Balao, Ecuador; *Goeldi* 52, Para, Brazil: and *Morong* 693, Paraguay.

Panicum cordatum Doell,[35] the type of which, *Glaziou* 4326, Rio de Janeiro, so named in Doell's script, was examined in the Berlin Herbarium, belongs to this species.

71. PANICUM PASPALOIDES. "Ad fossas udas prope Rio-Janeiro." The specimen belongs to *Panicum geminatum* Forsk. as described by Hitchcock and Chase,[36] North American Species of Panicum.

72. PANICUM DIVARICATUM. "In sepibus proximus Rio Janeiro, ut etiam alibi, praecipue ad fossas udas." Raddi does not publish this as his own species, but gives Linnaeus as author. The specimen is *Lasiacis ligulata* Hitchc. & Chase.[37]

[30] Mart. Fl. Bras. 2[1]: 238. 1877.
[31] Bot. Jahrb. Engler **56**: Beibl. **125**: 4. 1921.
[32] Proc. Biol. Soc. Washington **21**: 1. 1908.
[33] Proc. Biol. Soc. Washington **21**: 5. 1908.
[34] Spreng. Syst. Veg. **1**: 322. 1825.
[35] Mart. Fl. Bras. 2[3]: 239. 1880.
[36] Contr. U. S. Nat. Herb. **15**: 30. 1910.
[37] See Hitchcock's revision of Lasiacis, Contr. U. S. Nat. Herb. **22**: 18. 1920.

73. PANICUM MACROPHYLLUM. "Juxta torrentes in vicinis Mandioccae, et in Montibus Estrellensibus." The specimen is mounted on two sheets, one of three leaves, the sheaths overlapping, the blades 30 cm. long and 8.8 cm. wide; the other (evidently the summit of the same culm) with two leaves, the upper blade much reduced and split to the base, and a panicle 18 cm. long and 7.5 mm. wide. The spikelets are crowded, 2.3 mm. long, the glumes and sterile lemma subequal, the lemma slightly longer, acute, scabrous on the nerves and pubescent near the margins, the sterile palea nearly as long as its lemma; the fruit is elliptic, subacute, smooth and shining, 1.8 mm. long, 0.6 mm. wide. The species is allied to *Panicum latissimum* Mikan and *P. secundum* Trin. It differs from the first in the strict panicle branches and the equal glumes, and from the latter in the much broader blades. I have seen nothing like Raddi's specimen except Jardim Botanico do Rio Janeiro no. 575 (no locality but "Brasil") in the U. S. National Herbarium. This differs from the type in having sheaths sparsely appressed-pilose, and somewhat firmer blades, which are split as is the upper blade in Raddi's specimen.

75. PANICUM PURPURASCENS. Raddi states that it grows with the preceding (*Panicum maximum* Jacq.) which is cultivated throughout the province of Rio Janeiro and is also found growing spontaneously. The specimen consists of a flowering culm, lacking the base, of *Panicum barbinode* Trin., as described by Hitchcock & Chase.[38] The panicle is somewhat purplish.

77. PANICUM RUDGEI (β) BRASILIENSE. "Species rarissima observata tantum in vicinis fluminis Inhumirim, in locis silvosis et herbosis." The specimen consists of two pieces, one of four panicles, three axillary and a terminal one close together, each exceeded by its blade; the other of a single panicle and leaf. The specimen belongs to *Panicum Rudgei* Roem. & Schult. as described by Hitchcock and Chase.[39] The nodes are slightly geniculate as noted by Raddi.

83. SETARIA SULCATA. "In marginibus fossarum udarum prope Catumby, non procul ab urbe Rio de Janeiro." The specimen is an entire rather small plant, the nodes and junction of sheath and blade yellowish hirsute, the broadest blade 18 mm. wide, deeply pleated, the panicle scarcely 2 cm. wide. It belongs to *Chaetochloa poiretiana* (Schult.) Hitchc. as described in Hitchcock's recent revision of Chaetochloa.[40] On the ticket is written in Raddi's script "*Setaria sulcata* nob., *Panicum sulcatum* Bert."

[38] Contr. U. S. Nat. Herb. **15**: 33. 1910.
[39] Contr. U. S. Nat. Herb. **15**: 139. 1910.
[40] Contr. U. S. Nat. Herb. **22**: 159. 1920.

Raddi cites "Bert. Excerpta de Re Herb. 14." This paper is not in the library of Washington. In another paper the same year[41] Bertoloni published *Panicum sulcatum* Bertol., citing Raddi's collection from Brazil. This is apparently described independently of *P. sulcatum* Aubl. 1775. *Glaziou* 17396, Rio Janeiro, though a larger plant, is very like Raddi's specimen.

86. POA BRASILIENSIS. "In sepibus prope Rio de Janeiro." The specimen could not be found. The description is as follows: "panicula elongata stricta, ramis alternis adpressis, spiculis lineari-lanceolatis subdecemfloris, valvula corollae interiore margine brevissime ciliata; foliis bi-aut tripollicaribus, acuminatis, rigidis, margine involutis, ligula nulla. *nob.* Gramini tremulo affine, paniculatum elegans majus, spicis minoribus et longioribus. *Sloan, H. J. p. 113. t. 71. fig. 1?* (mala)."

The original of the Sloane figure in the British Museum of Natural History was examined by Dr. A. S. Hitchcock in 1907. It is *Eragrostis cubensis* Hitchc., which is not found in Brazil.

Nees[42] transfers *Poa brasiliensis* Raddi to *Eragrostis* "excl. synon. Sloanei." and refers *E. bahiensis* Schrad.[43] to it as a form with blades ciliate at base. Short-leaved specimens of this species, such as *Capanema* 5379, and 5386, Brazil, agree well with Raddi's description. The ligule is not wanting as stated by Raddi, but is very minute.

89. MEGASTACHYA SWAINSONI. "Species rarissima, quam mihi benevole communicavit D. Swainson red. ex itinere Pernambucano ad Urbem Rio-janeiro." The specimen is a small tuft of *Eragrostis maypurensis* (H. B. K.) Steud., with small, somewhat capitate panicles, as in Jardim Botanico do Rio de Janeiro no. 5535, collected by Luetzelburg; 3742, collected by Löfgren, and 5382 collected by Capanema.

BOTANY.—*Opsiandra, a new genus of palms growing on Maya ruins in Petén, Guatemala.* O. F. COOK, Bureau of Plant Industry.

A palm that grows in the ruined Maya cities of Petén apparently has not been described. The ruins are buried in the forest, with palms and other trees often growing upon the terraces, walls, or roofs of the buildings. The chief center of the early Maya civilization, in the district of Tikal, Uaxactun, Nakum, and Naranjo, is supposed to have been abandoned about fifteen centuries ago, and now is completely

[41] Opusc. Sci. Bologna **4**: 230. 1820.
[42] Agrost. Bras. 497. 1829.
[43] In Schult. Mant. **2**: 318. 1824.

overgrown with tropical vegetation. The outlook from the high pyramids in all directions is an undulating, unbroken forest. The present conditions are to be considered as a result of reforestation, not only of the sites of the cities, but probably of the whole surrounding region. It is a regular consequence of the primitive system of agriculture to reduce a forest country to an open, fire-swept grassland.[1]

Though tropical forests are restored rapidly in small clearings, the reforestation of an extensive grassland necessarily is very gradual, with a long succession of different conditions and types of trees to be established and replaced before there can be a complete return to the original state of the undisturbed, or "virgin forest." Some elements of the forest flora come in very slowly, even after apparently favorable conditions have been established. Thus there may be new forests with no palms in the undergrowth, though several kinds of palms may be found in older forests near by. In more advanced stages of reforestation palms may be abundant, but represent only a few species, which is true of the forests of Petén.[2]

The rapid destruction of the ancient cities by the forest, now to be witnessed in the Petén region, is evidence against the idea of very great antiquity, estimated by some archaeologists in thousands of years. In view of the damage now being done by the growth and uprooting of large trees, it does not appear that many centuries will be required to reduce all of the massive structures to shapeless mounds. The destruction tends, no doubt, to accelerate as the soil deposits accumulate among the loosened stones and the trees grow to larger size before uprooting. Several centuries may have passed after the cities were abandoned before they were covered by the forest. The dates that have been deciphered from the sculptured monuments are from a period corresponding to the early centuries of the Christian Era, though doubtless the city-building age was preceded by a long period of agricultural development. The Maya system of chronology used in dating the monuments would go back to about 3500 B.C.

The new palm would not be classified ecologically with the undergrowth species, but as a true forest type, growing to the same height as many other trees. It has a rather slender trunk, about 6 inches in

[1] See "Milpa Agriculture, A Primitive Tropical System," Smithsonian Report for 1919, pp. 307–326.

[2] Of the undergrowth species an *Acanthorhiza* is by far the most abundant, two species of *Chamaedorea* (*C. elegans* and *ernesti-augusti*) are common, and three others of occasional occurrence. Two large forest palms are also very common in some localities, *Attalea cohune* and a very tall, slender palmetto, locally known as *botán*. The *taciste* palm, a species of *paurotis*, grows in open places and survives burning over.

diameter, supported on a solid conical mass of thick roots, and attaining a height of 60 feet or more. The leaves are large and pinnate, but few in number, usually only 5 or 6, with a total length of 8 or 9 feet, and about 90 pinnae on each side of the midrib. The inflorescences are several joints below the leaves, with the branches robust and mostly simple, and ripening into large clusters of red cherry-like fruits, like those of *Synechanthus*.

As the Tikal district is now entirely uninhabited, no uses of the palm were learned, and the only name to be learned was *palma cimarrona*, or "wild palm." At El Cayo, in British Honduras, one informant gave *cambo*, or *kambo*, as the Maya equivalent of *palma cimarrona*. But the palm was not noticed in the vicinity of El Cayo, nor along the Belize River, though it was seen at several places on the road between Flores and Benque Viejo, as well as in the forests to the northward.

Since the fruit and floral characters are those of the Synechanthaceae the new palm may be assigned to this family, which includes only three other genera, *Synechanthus* in Guatemala, *Gaussia* in Cuba, and *Aeria* in Porto Rico. The tall trunk would associate *Opsiandra* with the West Indian genera, but there is no such swelling of the lower part of the trunk as in *Aeria*. Also, *Opsiandra* has 4 spathes, instead of 7 as in *Aeria*, or 2 as in *Gaussia*. Between *Opsiandra* and *Synechanthus* there is little external resemblance, the latter being a short-trunked undergrowth palm with clustered pinnae and slender, fastigiate inflorescence-branches.

Diagnostic features of *Opsiandra* are the tall, columnar trunk, the infrafoliar inflorescences, the 4 short, narrow spathes, the thick simple branches of the spadix, the flowers only 2 or 3 in each cluster, the petals thick and valvate in both sexes, the persistent staminate buds, and the transversely reniform seeds, with uniform albumen and a central cavity. The most striking peculiarity is that the inflorescence branches are robust and simple, while in the other genera the branches have numerous slender divisions and the flowers more definitely in rows.

The technical characters of the new genus may be summarized as follows:

Opsiandra Cook, gen. nov.

Trunk solitary, erect, ascending or flexuous, columnar below, slightly and gradually tapering above, scarcely enlarged at the base, supported by a conical mass of very thick roots.

Leaves few, usually 5 or 6, ascending, 2 to 3 meters long, with a cylindrical sheathing base; petiole distinct, deeply channelled below and with strongly

incurved margins above; pinnae numerous (88 pairs), lanceolate, not clustered or grouped, attaining a length of about 60 cm. and a width of nearly 4 cm.

Inflorescences distinctly infrafoliar, slender, with numerous (15 to 30) rather robust, simple, tapering branches, or a few of the lower branches forked near the base.

Spathes 4, slender, incomplete; 3 upper joints of the peduncle without spathes. Lowest spathe short and strongly bicarinate; third and fourth spathes longest, but not attaining the base of the branches of the matured inflorescence.

Flowers of one form externally, in longitudinal rows of 2 or 3, the lowest flower of each group pistillate, somewhat smaller than the staminate flowers, also a few solitary staminate flowers near the ends of the branches; sepals rounded, broadly imbricate; petals broadly triangular, valvate, somewhat longer than broad, thick, fleshy, persistent, becoming leathery in the ripe fruit; stamens 6, on broad short filaments; pistillodes columnar or variously compressed, sharply apiculate, nearly as long as the anthers; pistillate flowers with rudimentary staminodes, the pistil sharply trigonal, on each face a distinct median groove, the mature stigmas divaricate, persistent at the base of the ripe fruit; also some of the staminate buds persistent through the fruiting period.

Fruits globose-reniform, with a distinct groove on the median face above the stigma, color light green, turning to deep red when ripe, with a smooth skin and a soft fleshy pericarp, enclosing a somewhat depressed or subreniform seed. Surface of seed nearly smooth, slightly impressed with 5 to 7 simple or sparingly branched or anastomosing fibers rising from the inner or median side of the hilum, passing over and around the seed and converging toward the embryo; albumen uniform, with a central cavity; embryo about intermediate between basal and lateral, on the outer side of the seed away from the stigma; embryo cavity about half as broad as long, extending more than half-way to the central cavity.

Seedling with three bladeless sheaths, followed by two leaves with simple bifurcate blades.

The generic name refers to the persistence of the staminate flowers and buds which are to be found in fresh condition on the same inflorescences with ripe fruits. This may indicate an extreme condition of proterogyny or a continued production of staminate flowers through a long period. Monoecious palms may be considered as proterogynous if the stigmas are exposed before pollen is shed from the staminate flowers of the same inflorescence. Drude alludes to the opposite relation, of female flowers developed after the male flowers have withered. The difference usually would be only a few hours, or at most a few days, whereas several weeks must be required, or possibly months, for the fruits of *Opsiandra* to grow and ripen, while staminate buds and flowers are still present.

Opsiandra maya Cook, sp. nov.

Trunk attaining 20 meters and upward, about 15 cm. in diameter near the base, tapering slightly and gradually; internodes 12 to 15 cm., becoming shorter above, separated by distinct rings. Superficial roots 3.5 cm. thick, forming a dense conical mass supporting the trunk.

Leaves 2 to 3 meters long; sheath and petiole not distinct, the strictly sheathing portion about 30 cm. long, the petiole about 65 cm., very deeply channelled below, with thin strongly incurved margins to within about 15 cm. of the lowest pinnae, there the groove becoming shallow and the margins rounded. Sheath 1.5 cm. thick at the back, the petiole becoming thicker above and the groove more shallow; diameter of petiole above 3 cm. Rachis sharply carinate above.

Pinnae 88 on one side of the midrib; lowest pinna 41 cm. by 2.2 cm.; second pinna 47 cm. long; largest pinna somewhat below the middle, 61 cm. by 3.8 cm.; fifth pinna from the end 32 cm. by 2.7 cm.; subterminal pinna 22 cm. by 1.3 cm.; terminal pinna 16 cm. by 0.5 cm., or the two last pinnae united with total width of 1.5 cm. One vein on each side of the midrib more prominent than the others, especially underneath, also 5 or 6 less prominent veins, separated by 6 or 7 subequal veinlets; in dry specimens the spaces between the veinlets showing many short translucent longitudinal lines, not in regular rows; submarginal vein delicate, separated from the margin by 3 or 4 veinlets very close together; margin thickened and veinlike, but the edge thin.

Inflorescence 75 cm. long; from lowest branch to tip 34 cm. Branches 17 or 18, about 0.4 cm. thick, at base nearly 0.5 cm. tapering gradually to the tip, attaining 30 cm. The lowest 4 branches divided near the base; terminal portion 21 cm. Peduncle with 7 joints measuring respectively 2, 11, 7.5, 12, 11, 5, and 3 cm., the last 3 joints without spathes.

Spathes 4, the lowest 9.5 cm. by 5.5 cm., distinctly carinate on each side, deeply bidentate, the tips triangular-pointed, 3 cm. long; second spathe 13.3 cm. by 4.3 cm., slightly carinate, but sharply angled at the sides; like the others; third spathe 19.5 cm. by 2.4 cm.; fourth spathe 19 cm. by 2.1 cm., attaining within 2 to 3 cm. of lowest branch, the fruiting portion emerging from the spathes long before flowering.

Sepals about 1 mm. long; petals of female flowers at anthesis about 2 mm. long, on ripe fruits 3 mm. long, thick; anthers 1 mm. long, and pistillodes nearly the same length, staminodes rudimentary.

Fruits subglobose or transversely subreniform, somewhat flattened on one side and with a vertical groove above the stigma, 1 cm. to 1.5 cm. in diameter, with a soft fleshy red pericarp 2 mm. thick, the flesh of green fruit mucilaginous and very sticky; seed 0.9 cm. to 1.1 cm. in diameter, somewhat irregular in shape, subglobose, oblong, reniform, oval, or unsymmetrical, the surface smooth or slightly uneven, marked with a few impressed fibers; central cavity of the seed often strongly depressed, 2 to 4 mm. in diameter, surrounded by a wall of uniform rather hard albumen 2.5 to 3 mm. thick.

Seedlings with the three bladeless sheaths measuring respectively, 7 cm., 2.5 cm. and 5 cm. in length, in diameter about 0.5 cm.; first two sheaths without chlorophyll, white at first but soon brown and decayed; first two leaves simple, deeply bifid, the divisions measuring 12 to 13 cm. by 1.3 to 1.9 cm.

Type in the U. S. National Herbarium, nos. 1,084,215–1,084,219, consisting of leaf parts, inflorescence, and spathes from a single individual growing at Laguna Colorada, Tikal District, Petén, Guatemala, altitude 100 to 500 meters, March 23, 1922, by O. F. Cook and R. D. Martin (no. 94), of which photographs and complete leaf measurements were obtained. Ripe fruits were collected a few days later near Uaxactun, on a larger inflorescence, with more numerous branches and the fruits more abundant and crowded. The seeds of this cluster were brought to Washington and planted in a greenhouse, where the seedlings have grown well.

Young palms were noted among the ruins of Nakum with petioles much longer and more slender than those of the adult palm at Laguna Colorada. Also, in the young palms the pinnae are relatively broader than in the adult, 1.5 to 2 cm. wide with a length of 18 to 20 cm. An injured leaf of a young palm growing on a ruined temple at Uaxactun showed a special enlargement of the basal pulvini, so that the pinnae stood nearly at right angles to the rachis instead of the usual angle of about 50 to 60 degrees in young palms, or about 40 degrees in adults.

Since northern Petén has a dry season sufficiently long and severe to throw most of the vegetation into a dormant condition, it seems not unreasonable to expect that *Opsiandra* may prove somewhat resistant in more temperate climates and possibly adapted to household cultivation or to outdoor conditions in Florida or California. As a popular name the expression "Maya palm" might be used, in view of the habitat and frequent association with the ancient ruins.

ZOOLOGY.—*A new frog of the genus* Leptodactylus.[1] DORIS M. COCHRAN, National Museum. (Communicated by Dr. L. STEJNEGER.)

A collection of reptiles and batrachians recently sent to the United States National Museum by Dr. W. L. Abbott contains an interesting new frog, of which I have prepared the following description:

Leptodactylus dominicensis, sp. nov.

Diagnosis.—Toes without distinct dermal margins; tongue heart-shaped; tympanum half the width of the eye; vomerine teeth in two long curved series behind the choanae; snout pointed, depressed, with a sharp edge.

Type.—U. S. N. M. No. 65670, Las Cañitas, Dominican Republic; February 25, 1923; Dr. W. L. Abbott, collector.

Description of type specimen.—Vomerine teeth in two long curved series beginning behind the middle of the choanae, separated by the width of the choanae; tongue moderate in size, heart-shaped; snout pointed, depressed, sharp-edged, declining rapidly from the eyes to the tip; when viewed in profile, upper lip projects considerably beyond lower lip; canthus rostralis sloping and very indistinct; nostrils a little nearer to end of snout than to eye; tympanum longer than high, its greatest diameter very slightly more than half the diameter of eye; interorbital space equals width of upper eyelid; first finger much longer than second, which equals fourth; toes slightly webbed at base; third much longer than fifth; subarticular tubercles well developed; numerous smaller tubercles in series on the sole; two metatarsal tubercles, the inner connected with a very distinct tarsal fold; heels just touching when hind limbs are folded at right angles to axis of body; tarso-metatarsal joint reaching anterior border of tympanum when hind limbs are carried forward along the body; skin smooth above and below; numerous small, pointed glands on the outer surface of the tibia; a narrow dorso-lateral glandular fold, and a few elongate glands on the sides; a strong glandular fold from posterior angle

[1] Published by permission of the Secretary of the Smithsonian Institution.

of eye over tympanum to shoulder; ventral disk plainly marked by dermal folds.

Dimensions.—Tip of snout to vent, 36 mm.; tip of snout to posterior edge of tympanum, 13 mm.; greatest width of head, 13 mm.; fore leg from axilla, 19 mm.; hind leg from vent to heel, 26 mm.; hind leg from vent to tip of fourth toe, 49 mm.

Coloration (in alcohol).—Body dark bluish-gray above, becoming lighter on the sides; the sharp rim on the snout white; the head dark gray with a blackish bar between the eyes; a black band from eye across tympanum to shoulder; arms and legs light with darker bands and markings; a white line on the posterior femur; underside whitish, the throat finely sprinkled with pale gray.

Remarks.—This frog is closely related to *Leptodactylus albilabris* from Porto Rico. The snout is shorter and broader, and the projecting edge on the upper lip is far more pronounced. Then, too, the hind legs are shorter, and the examination of the mouth reveals a deeply incised tongue, while the tongue of *L. albilabris* is only slightly nicked behind.

ZOOLOGY.—*A new lizard of the genus* Sceloporus.[1]

DORIS M. COCHRAN, National Museum. (Communicated by Dr. L. STEJNEGER.)

While identifying the lizards collected in Mexico by the Biological Survey and now in the United States National Museum, I came upon a species of *Sceloporus* which seems to be new to science.

Sceloporus nelsoni sp. nov.

Diagnosis.—Lateral scales directed obliquely upwards and backwards, and passing gradually into the dorsals; series of femoral pores widely separated, not meeting on the preanal region; tail strongly compressed; head-shields smooth; two rows of granular scales between supraoculars and supraciliaries; femoral pores 15 to 20.

Type.—U. S. N. M. No. 47676; Plomosas, Sinaloa, Mexico; July 18, 1897; Nelson and Goldman, collectors.

Description.—Head-shields smooth; frontal ridges fairly prominent; frontal transversely divided, in contact with the interparietal, which is a little broader than long; a single large parietal shield on each side of the interparietal; fronto-parietals in contact with last two supraoculars; two canthal scales; five transverse supraoculars, bordered inwards by an incomplete series of small scales, and separated from the supraciliaries by two rows of almost granular scales; five scales, not larger than those before them, form a denticulation on the anterior border of the ear; dorsal scales much larger than ventrals, strongly keeled, mucronate, forming slightly converging series; 35 scales between the interparietal shield and the base of the tail; 9 scales, taken in the middle of the back, correspond to the length of the head; ventral scales small, smooth, bi- or tricuspid; about 36 scales around the middle of the body; the adpressed hind limb reaches between ear and eye; tibia as long as distance between end of snout and ear; the distance between base of

[1] Published by permission of the Secretary of the Smithsonian Institution.

fifth toe and extremity of fourth exceeds the distance between end of snout and posterior border of ear; 15 femoral pores on each side; tail distinctly compressed; caudal scales larger than dorsals, strongly keeled and mucronate except those on basal third underneath, which are smooth; males with slightly developed post-anal scales.

Coloration (in alcohol).—Bronze-colored above; a broad, dark stripe along each side with a light area above; a black vertical bar in front of the shoulder; head reddish brown spotted with darker; lips with dark vertical bars; a very noticeable black spot encircled with a ring of light yellow on the posterior margin of the parietal shield, not involving the "pineal eye"; throat with oblique bluish bands converging posteriorly; breast yellowish; sides of belly pale green, broadly edged with blackish blue near the median ventral line.

Dimensions.—Snout to vent, 56 mm.; shielded portion of head, 13 mm.; snout to ear, 14 mm.; length of fourth toe, 15 mm.

Remarks.—Although the new species resembles *Sceloporus pyrocephalus* Cope in many of its characters, there are several striking differences which will enable the two species to be distinguished immediately. The black spot on the parietal shield, which in *S. pyrocephalus* encircles the "pineal eye," in *S. nelsoni* is on the extreme posterior border of the parietal, not involving the pineal eye, and is itself encircled by a ring of light color which becomes slightly darker just anterior to the black spot. The snout is quite flat in *S. pyrocephalus;* one row of regular scales separates the supraoculars and the supraciliaries. In the new species the frontal ridges are fairly prominent; there are two irregular rows of small scales separating supraoculars and supraciliaries; the dorsal scales are larger and more spiny, and the femoral pores are more numerous. The ventral coloration of the two species is entirely different—in the males of *S. pyrocephalus* there is a startling black and white herring-bone pattern of convergent stripes, while in the *S. nelsoni* the pale blue areas on the sides are simply edged with black, as in the large majority of the *Scelopori.*

In addition to the type, there are 10 specimens in the National Museum, five from near Mazatlan, one from Culiacan, three from Rosario and one from Barranca Ibarra. The coloration is constant, except that the specimens from near Mazatlan are somewhat lighter. The femoral pores vary in number between 15 and 20.

The new species is named in honor of Dr. E. W. Nelson, Chief of the Biological Survey.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

BOTANICAL SOCIETY

158TH MEETING

The 158th meeting of the Society was held at the Cosmos Club at 8 P.M., Tuesday, March 7, 1922, 66 members and guests being present.

Dr. A. D. HOPKINS was elected to membership.

Under Brief Notes and Reviews of Literature, Dr. A. S. HITCHCOCK showed the Society a sample of paper from bamboo, the paper having been made in France. He stated that no paper in the United States was made from a grass.

Dr. RUDOLF KURAZ, Agricultural Attache and Secretary to the Czechoslovak Legation gave an address on *Agriculture in Czechoslovakia, and the achievements of the Czechs in American agriculture.* At the close of the regular program, two motion pictures were shown by Dr. KURAZ, one on Prague, the capital city, and the second on the national Sokol.

Prof. DAVID LUMSDEN addressed the Society on *Raising orchid seedlings by the use of a mycorrhizal fungus.*

The presence of endophytic fungi in the roots of certain plants of the order Orchidaceae has been described by several authors. It was Link[1] who first observed them in the protocorm of *Goodyera procera*, an orchid native to India and Malaya. He did not attempt to describe the fungus, merely stating that the cells were filled with a colorless granular material which later disappeared.

The term mycorrhiza was used first by Frank[2] in 1885 to describe the infection of the roots of a plant by a fungus. It was not however until 1903 that serious consideration was given to the reasons for the affinity existing between an orchid and a fungus. During the year 1909 Hans Burgeff contributed a valuable publication, "Die Wurzelpilze der Orchideen" dealing on the subject. The same year Noel Bernard published an article showing that when the seeds were sown under aseptic conditions the embryos swelled and formed green spherules and finally died; when sown on pure cultures of the endophytic fungus isolated from the roots of these plants, the embryo developed normally, forming a spheroid body which soon produced a cotyledon and papillae with long root hairs.

Further investigation conducted by Bernard and Burgeff at that time showed that the germination of orchid seed did not occur except in the presence of the root fungi.

The speaker having studied very closely the methods pursued by Bernard and Burgeff carried out numerous experiments with several genera and species of orchidaceous plants to ascertain the value of fungoid infection in the germination of orchid seeds. Cellulose, starches, agar and other nutrients were also used as mediums on which to germinate the seed.

Various kinds of wood kept under normal and abnormal moisture conditions were also used. The most satisfactory results were obtained when the seeds were sown in 4 to 5 inch flower pots, containing 50 per cent osmunda fiber;

[1] H. F. Link. Icones selectae anatomico-botanicae II p. 10, t. VII, 1840.

[2] A. B. Frank. Ueber die auf Wurzelsymbiose beruhende Ernahrung gewisser Baume durch unterirdische Pilze Ber. d. deutsch. bot. Gesell. III. pp. 128-145 (1885) Lehrbuch der Botanik Bd. I (1892) p. 264.

50 per cent sphagnum moss, the medium being covered over with fine woven clean burlap and the flower pot when prepared being thoroughly sterilized in an autoclave. The third day after sterilization, if no infection manifested itself, the rhizoctonia was introduced to each of the experimental pots. Check pots were also kept for comparison. Moisture conditions were maintained by placing saucers of water in the propagating frame. A temperature of 80° to 85°F. with a relative humidity test of 75 to 82 per cent was maintained. The speaker had a few seedlings appear promiscuously on a few of the check pots which had not been infected. This may have been due to contamination as the check pots were placed side by side with those infected with the fungus.

While several nutrient solutions were used, including Pfeffer's, Burgeff's, and Crones', the culture giving the most satisfactory results was the one recommended by Burgeff, which is here given.

Burgeff's solution

	grams
Potassium dihydrogen phosphate	1.0
Calcium chloride	0.1
Sodium chloride	0.1
Magnesium sulfate	0.3
Iron chloride	0.01
Ammonium chloride	0.5
Distilled water	1000.0

Other nutrient solutions such as sugars, from 1 to 2 per cent solutions, glucose gelatin and non-liquefiable nutrient (potato) were also used in the experiment.

Roots growing in the air and roots from potted plants were utilized in making inoculations. The roots before using for inoculation and the seeds before being sown were subjected to sterilization by immersion for 2 to 3 minutes in a 7 per cent solution of calcium hypochloride.

Small pieces of the orchid root about $\frac{1}{2}$ inch long were used and transferred to the Petri dishes and test tubes containing the nutrient agar. In the cases of the flower pots, the small sections of the roots containing the rhizoctonia were placed under the burlap.

Out of a series of several hundred cultures only two organisms occurred with any noticeable regularity. Average contamination was manifest both in the test tubes and also in the flower pot method.

It is the opinion of the speaker that orchidaceous plants having a long line of ancestors and being the most specialized of all plants are necessarily dependent on other than ordinary food and environmental conditions which govern the life cycle of the masses of the lower plants. The orchid seed is very minute and devoid of endosperm. It has therefore acquired the habit of depending on the various root fungi for its early existence.

Further investigation with a large number of generic crosses demonstrated that a separate organism is required for a particular genus and possibly for particular species. As some results were obtainable under aseptic conditions it can not be said that the fungus is entirely essential but it is incontestable that the rhizoctonia promotes the germination of the seeds. It is nevertheless true that its presence is not indispensable and that a satisfactory germination can be obtained without its introduction.

Symbiosis opens up a wide field for investigational work and progress along this line is reaching more definite conclusions and perhaps we may find that a "well balanced ration" or the proper proportioning of plant food in each case for genera and species will reveal the "undiscovered secret of

nature" if so we may term it. For the present, investigation rather shows the affinity between the orchid seed and the fungi to be one of mutual parasitism rather than mutual symbiosis.

E. T. WHERRY concluded the program by remarks on the *Cultivation of our native orchids with special reference to their relation to soil activity.*

159TH MEETING

The 159th meeting of the Society was held at the Cosmos Club, Tuesday, April 3, 1922, at 8 P.M. with President SAFFORD in the chair and 55 members and guests present.

Dr. A. S. HITCHCOCK showed specimens of rattan from China. This rattan palm was very bad for travelers, on account of the spikelets. He also showed samples of wild rice from southeastern China, which he stated were the prototypes of cultivated rice.

Dr. N. A. COBB gave an illustrated address on *The coconut industry, its economic importance, and a serious disease of the coconut caused by a nematode.* —The coconut industry is a very large one, but its size and importance are frequently not appreciated, even by experts. The coconut enters into the manufacture of soaps as an oil, into milk as a filler, while it is well known as a food, and used in cake frostings, cookies and candies. The dried meat of the coconut is the copra of industry. Thousands of miles of sea coast in the tropics are adapted to the growing of coconuts.

Fifteen years ago a disease was reported from Tobago and Trinidad, which came to be known as the coconut root disease. No one at this time realized that a nematode was the cause of this disease. Only a few years ago the first nematode was obtained from a diseased coconut by a Mr. Nobb, of the Imperial Dept. of Agriculture of the West Industries, though he did not at first recognize it as the causal agent of the disease. The identification of the nema and the proof that it caused the root disease was made by Dr. N. A. Cobb of the U. S. Dept. of Agriculture. The nema was determined to be a hitherto unrecognized species and was given the name *Aphelenchus cocophilus,* and the disease later came to be known as Red Ring of the coconut.

An estimate of the number of nemas in a single foot length of a coconut root shows about 20,000 present. The address was finely illustrated by colored slides of various nemas, as well as the sick and dying coconut palms, infested with *Aphelenchus cocophilus.*

160TH MEETING

The 160th meeting of the Botanical Society of Washington was held at the Cosmos Club, Tuesday, May 2, 1922 President, W. E. SAFFORD presiding.

Dr. TYOZABURO TANAKA spoke on the *Citrus fruits of Japan, with notes on their history and the creation of new varieties by bud variation.* The orange goes back into Japanese mythology. Foreign citrus were introduced into Japan, as early as the first century. The general extent of the culture of the most important species and varieties of citrus grown in Japan were discussed. Several cases of the origination by bud variation of the variety Wase from the variety Owari were observed during recent citrus studies in Japan.

Dr. H. L. SHANTZ gave an illustrated talk on the *Botanic Gardens of South Africa.* The National Botanic Gardens of South Africa at Kirstenbosch, the best known in that part of the continent, were visited by the Smithsonian African Expedition in August 1920. The Gardens are supported largely by

private subscriptions from individuals, and the Botanical Society of South Africa, by the Cape Town Government, and by a grant from the South African government, though considerable income is secured by the sale of wood and by products from the Gardens.

The Gardens are situated on the side of Table Mountain. A large portion of it is relatively level, but at the back it slopes up to the top of the mountain, thus affording a great diversity of slope and elevation. The most interesting fact about the gardens is that their primary purpose is to bring together the native flora of South Africa, so far as possible, rather than to show a fine collection of exotic plants. Chief of note among the gardens is the Cycad amphitheatre, which contains probably the largest collection of these plants in the world. There were interesting collections of *Stangeria* and *Encephalartos*. Additions to the cycads have been made from America and Australia.

At another place nearby is the Aloe Garden or Kopje, represented by many genera and containing many of the more beautiful species from all over South Africa. Then there is the Bulb Garden, the Fern Dell, the Bolus Orchid Garden, and the Pelargonium and Protea collections.

Mr. R. H. Comton, Director of the Gardens, is also Professor of Botany at the University of Cape Town.

The Gardens at Lorenco Marques, in Mozambique, were also visited. This beautiful garden contains many of the finest of the East African plants as well as many exotics, and was developed largely by Thomas Honey and Senor Almeida. There is also a very attractive botanic garden at Pretoria, under the direction of the Botanical Department, of which Mr. I. B. Pole-Evans is the head. Here there was a specially interesting collection of xerophytic plants.

162D MEETING

The 162d meeting of the Botanical Society was held at the Cosmos Club at 8 p.m., November 7, 1922, with Dr. L. C. CORBETT, newly elected president, in the chair and 84 persons present. PHILIP BRIERLEY and Dr. A. G. JOHNSON were elected members.

Under Brief Notes, Mr. P. L. RICKER spoke of the proposed Mt. Hamilton Botanical Garden site, and suggested that a leaflet be prepared by the Botanical Society and the Wildflower Society and sent to members and others interested in the project. Dr. A. S. HITCHCOCK was authorized to present the matter of the proposed National Botanic Garden to the Botanical Society of America at their Boston Meeting.

Dr. A. S. HITCHCOCK spoke of finding in the Island of Hainan and in Indo-China a rare grass, *Chloris tenera*, originally described as *Cynodon tener* Presl. The grass was said to have been collected by Haenke at Sorzogon on Luzon in the Philippines. Dr. E. D. Merrill, Director of the Philippine Bureau of Science, had thought that this species was erroneously credited to the Philippines, as it was not known to occur in the Islands; and that it was probably a native of America. The Melaspina Expedition, to which Haenke was attached, had visited the western coast of America from Chile to Alaska before going to the Philippines. The specimens now at Prague are labelled incompletely and in some cases the locality is erroneous or even lacking. Since Dr. Hitchcock's visit to the Orient, Dr. Merrill has seen specimens of this species from near the type locality, thus confirming Haenke's original statement.

Program: Dr. W. A. ORTON: *Physiatric botany* (illustrated). The history of diet is divided into three periods, ancient, medieval, and modern. The medieval period is the one of the chemical view of foods. The modern is the Biological Period. It began about 1900 with the recognition of the importance of vitamines. Vegetables are important in the diet. Especially is this true in the cases of diabetes, nephritis, and other similar diseases. Many kinds of vegetables are available to furnish adequate variety to the diet.

Dr. F. E. KEMPTON: *Barberry eradication in the United States.* Barberry eradication began in Europe in 1795. Satisfactory results were obtained. The American wheat rust epidemics of 1904 and 1916 awakened interest in the subject and active work began with the passing of the South Dakota anti-barberry law in 1917. The present campaign for barberry eradication was begun in April 1918. A preliminary campaign of education and survey was organized, and the field work was begun about April of that year. Congress appropriated in 1918, $150,000 for barberry eradication. Since that time eradication has been conducted in cooperation with each of the following 13 states: Colorado, Illinois, Indiana, Iowa, Michigan, Minnesota, Montana, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin, and Wyoming. A federal quarantine was placed, effective May 1, 1919, prohibiting the movement into the eradication area of any barberries known to harbor the black stem rust of wheat and other grains. A much larger appropriation of $350,000 became available July 1, 1922, under which marked progress has been made during the field season of 1922. During the five years, 1918–1922, practically all cities and villages of the 12 states have been covered once and resurveyed in part, and 472 counties have been completely covered. This includes 39 counties surveyed on funds furnished by states. In the 5 years, 2,069,017 bushes have been found in cities and villages and 3,740,351 on farms, making a grand total of 5,829,368 bushes found, of which 5,173,547 have been removed.

ROY G. PIERCE, *Recording Secretary.*

SCIENTIFIC NOTES AND NEWS

The National Geographic Society announces a series of Contributed Technical Papers embodying the scientific results of its expeditions. The first number entitled "*The origin and mode of emplacement of the great tuff deposit of the Valley of Ten Thousand Smokes,*" by C. N. FENNER of the Geophysical Laboratory, which cooperated with the Geographic Society in the Katmai Expedition, is now ready.

Dr. FENNER's paper gives details of the hot sandflow not included in the nontechnical volume, "*The Valley of Ten Thousand Smokes,*" by the director of the expedition, ROBERT F. GRIGGS, recently published by the National Geographic Society.

This series of papers from time to time will embody researches in diverse fields of science resulting from National Geographic Society expeditions. Notices of their appearance will be sent to all who desire such notification. The papers themselves will be distributed only to those who specificially request them.

The Board of Managers of the Washington Academy of Sciences has elected the following scientists to honorary foreign membership in recognition of their prominence in their respective fields and their intimate connection with scientific work in Washington:

Professor LEON MANOUVRIER, Ecole d'Anthropologie, Paris, France, was elected in recognition of his life-long work of the highest class in anthropology.

Dr. CARL FREDERIK ALBERT CHRISTENSEN, Director of Universitetets Botaniske Museum, Copenhagen, Denmark, was elected in recognition of his services to systematic botany, particularly his monographic studies of tropical American ferns of the tribe Dryopterideae.

Dr. PAUL MARCHAL, Chef de Section, Service des Epiphyties, Ministry of Agriculture of France, was elected in recognition of his investigations in biological problems and their relation to agriculture, and especially for his research work in polyembryony.

Mr. EDWARD CLAYTON ANDREWS, Government Geologist of New South Wales, Sydney, Australia, was recommended in recognition of his distinguished work in geology, particularly in the fields of origin of coral reefs, physiography, origin of the Australian flora, mountain formation, and origin of metalliferous deposits.

Sir ERNEST RUTHERFORD, Director of the Cavendish Laboratory, University of Cambridge, England, was elected in recognition of his distinguished work in chemistry.

F. OMORI, Professor of Seismology, Imperial University, Tokyo, Japan, was elected in recognition of his outstanding work in the field of Seismology.

Professor GUISEPPI STEFANINI, Instituto di Studi Superiori, Pizza San Marco, Florence, Italy, was elected in recognition of his distinguished investigations in paleontology and stratigraphy, especially the tertiary formations of Italy and echinoids in general.

Professor MAX WEBER, University of Amsterdam, Amsterdam, Netherlands, was elected in recognition of his distinguished work in zoology.

The Biological Survey, U. S. Department of Agriculture, has arranged with the Navy Department for transportation for a party of scientists who will make a general survey during the spring and summer of the plant and animal life on the chain of islands extending from Niihau in the Hawaiian group to Midway and Wake. Dr. ALEXANDER WETMORE of the Biological Survey will have general direction of the scientific activities of the expedition, which will be carried on in part by members of the staff of the Bishop Museum, Honolulu. DONALD R. DICKEY of Pasadena will accompany the party to secure moving pictures of the remarkable colonies of sea birds on Laysan Island.

The speaker at the meetings of the Physics Club, Bureau of Standards, on March 19 and 26 was Dr. C. W. KANOLT, his subject being *Relativity*.

In the first lecture the older or special theory was considered. This was developed by Einstein mainly as a result of the failure of the experiments of Michelson, Morley, and Miller to detect a motion of the earth relative to the ether. Einstein postulated the independence of phenomena in a system moving with uniform velocity of the velocity of the system, provided the phenomena are observed from within the system. He postulated that the velocity of light is constant under all conditions, which means that it must be the same in all directions, independent of the velocity of the source and independent of extraneous influences, including gravitation. He also assumed tacitly the accuracy of Euclidean geometry. Some of the deductions from this older theory were described.

In the second lecture it was explained that the older theory did not agree with Newton's law of gravitation, and that to harmonize the two and also to extend the conception of the relativity of space and time Einstein had

developed a general theory of relativity, in which he abandoned the assumption that the velocity of light is independent of gravitation, abandoned Euclidean geometry but employed the more general geometrical ideas of Riemann, and introduced the hypothesis of the equivalence of a uniform gravitational field and a uniform acceleration of suitable magnitude. From this point of view the older theory is applicable only when gravitational forces are negligible. The consequences of the general theory relative to the perihelial motion of Mercury, the influence of the sun's gravitational field upon the paths of light beams from the stars and upon the wave length of spectral lines from the sun were discussed.

Dr. WALTER ROSENHAIN of the National Physical Laboratory, Teddington, England, spoke at the Bureau of Standards on Monday, April 2, on *The work of the National Physical Laboratory.*

An experimental test of Einstein's principle of equivalence was discussed by Dr. P. R. HEYL at the April 9th meeting of the Bureau of Standards Physics Club.

Miss ALICE C. FLETCHER died on Friday, April 6, in Washington, D. C., in her 79th year. She was born in Boston, Massachusetts, March 15, 1845. Her life was devoted to work among the American Indians, and she made numerous contributions to the literature of ethnology, her book, *Indian story and song from North America*, being her best known publication. For many years Miss Fletcher was assistant ethnologist at the Peabody Museum,and held the Thaw fellowship since 1891. She was a member of the ACADEMY and the following local scientific societies: Anthropological (President, 1893), Archeological, and Historical, as well as a number of national organizations.

Dr. AUGUST HUND has been appointed electrical engineer, Radio Section, Bureau of Standards. He is a graduate of the Technische Hochschule, Karlsruhe, and took the degree of Doctor of Engineering in 1913. He was with the General Electric Company under Dr. Steinmetz from 1915–1917, and has been doing graduate work at the University of California since that time. Dr. Hund has written a book on the technique of high frequency measurements.

THE APPARATUS CONFERENCE

A Conference of Makers and Users of Scientific Apparatus was held at the National Research Council on March 23 and 24. Representatives were present from the American Chemical Society, the American Physical Society, the American Institute of Electrical Engineers, the American Electrochemical Society, and the Optical Society of America. The Scientific Apparatus Manufacturers' Association and the Manufacturing Chemists' Association, as well as several manufacturers of apparatus and supplies, sent representatives. The universities were represented by the Association of Educational Buyers, and the Federal Government, by members of the Bureau of Standards, Bureau of Chemistry, Geological Survey, and other bureaus. Members of the Carnegie Institution and of the National Research Council were also in attendance. G. K. BURGESS of the Bureau of Standards presided.

The question of "Apparatus Supply" was covered by papers on *Importation* by Mr. EIMER of the firm of Eimer and Amend; *Domestic apparatus manufacture* by Mr. LEEDS of the Leeds and Northrup Company and Pro-

fessor RICHTMYER of Cornell University; *The Instrument shop of the research and college laboratory* by Mr. COLLINS of the Geological Survey; and *The Manufacture of special apparatus not now made in the United States* by Mr. IVES of the Western Electric Company.

The subject of "Standardization of Apparatus" was covered by papers on *Limitation of types and sizes* by Secretary ROBERTS of the Apparatus Manufacturers' Association; *Standardization of parts* by Mr. DICKINSON of the Society of Automotive Engineers; and *Standardization of methods* by Mr. BURGESS.

There were also papers on *Sources of information* by Mr. EARNSHAW of the Buyers' Association; *Finding list* by Mr. TISDALE of the Research Council; *Scientific Bulletins concerning apparatus and its use* by Mr. LEEDS; and *Inspection service* by Mr. WASHBURN of the Research Council.

There was active discussion of all of these papers. A permanent form of organization was adopted, consisting of a large committee or conference representing societies, institutions, and manufacturers, with a small executive committee elected by the conference. The members of the executive committee are: W. M. CORSE, Chairman, PAUL MOORE, Secretary, G. K. BURGESS, W. D. COLLINS, M. E. LEEDS, F. K. RICHTMYER, and JOHN ROBERTS.